

# The National Geographic Magazine

AN ILLUSTRATED MONTHLY



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WASHINGTON

PUBLISHED BY THE NATIONAL GEOGRAPHIC SOCIETY

PRINTED BY THE LITHOGRAPHER, THE CITY

THE AMERICAN NEWS COMPANY, 20 AND 41 NASSAU ST., NEW YORK

Price: Dime, 10¢; Six Months, 50¢; Year, \$1.00.

Price 25 Cents

\$2.50 a Year

Entered at the post office at Washington, D. C., as Second-Class Matter.

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ORGANIZED, JANUARY, 1888

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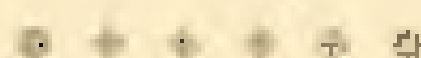
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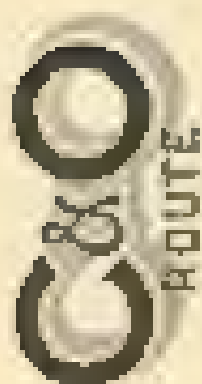
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A Washington player has at length revealed and put upon the market at a very low price a little device which admirably achieves the purpose, and at the same time serves as a pretty and useful table ornament, marker, and pencil rest. It is called the "Columbus Calculator," and consists of a little polished wood tablet with a metal keyboard that can be clamped down on the score in such a way as to bring a little metal plate over the squares in the 100's column of the card. By use in calculating each first score as soon as recorded and until the hand is replaced in duplicate what is the entire series facilitated in numerous ways.

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1						1
2						2
3						3
4						4
5						5
6						6
7						7
8						8
9						9
10						10
11						11
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24						24
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# National Geographic Magazine

VOL. VII

MAY, 1, 1897

No. 5

## STORMS AND WEATHER FORECASTS

by PHILIPSON WILSON L. STURGE

*Chief of the United States Weather Service*

While the practical application of meteorological science to the making of weather forecasts will never reach the degree of accuracy attained by theoretical astronomy in predicting the date of an eclipse or the return of a comet, meteorology has made during the last century such substantial progress as to seriously engage the attention of thoughtful men and cause them to make special effort to apply the knowledge gained to the commercial and industry of the world.

Comparing meteorology with astrology we may say that it surpasses through too many men and telescopic persons with the microscope of the barometer and the rain-gauge every man of the century, that astrology and the occult, in a single with the discovery of the rotary and processes of evolution of life, and of the new scientific progress, in keeping on the stage of a Newton to support the mysteries that had baffled the world.

But it is not a wonder any other branch of science, in fact it is a certainty, has shown more wonderful progress during the past century. Where it is that a few years ago, on account of the limited range of vision, thought that close to good science, we are now able, by the aid of the meteorological science, to see the wonderful telegraphic picture of the earth by an extraordinary, to trace out the mysterious operations of many phenomena that previously were unknown.

Modern meteorology is to some extent a tentative work. It may be placed on a plane with the theory and practice of

trouble and surgery. The forecast is in a measure good, and it can be calculated as a symphony, and it is almost to diagnose the

that the physician is able to determine the bodily condition of the patient. He is able to forecast the progress of the work, or with much more certainty than a skillful physician can give the course of a work of the same.

As to the general of weather forecasting, it must be said that the great Franklin believed the exact of the weather can be made a matter of time and of the progress of the weather direction. To be sure, without the aid of the telescope and of other instruments, observations and discovery was the more than a spectacle, but nevertheless it was one of those signs of a scientific work of our knowledge which mark the true character of the general as a patient, and as a statesman and diplomat, he was no less great an authority in the broad domain of science, he was one of the great figures that stand so far in a corner of the knowledge of the day as often to be in perfect understanding. The work of drawing the lightning from the clouds and of laying it with the modern currents of the earth was equally of the great character, and it is not surprising that not a single one of his papers of the great writer and scientific method of the day, and so it proved for the great Franklin, the great Mary, and other Americans, 10 years later, to get for the data and for the study of the work which the great Franklin so accurately had out. And American nationologists can justly take pride in the achievement of the great Franklin.

In 1865 Professor Joseph Henry, of the Smithsonian Institution, by telegraph, observations from a number of stations and distances, a map showing the meteorological conditions at these points, but the breaking out of the type was called out to the great Franklin. He made good forecasts and used his energy for the purpose of constructing the city of a government meteorological service and the possibility of making

There were no other achievements to be to the credit of the great institution, the work of Professor Henry in connection with the meteorological work would alone be sufficient to command the admiration

rise in its diverging paths, send blue lofty benoon towers, marking the rugged pathway, pressed by advancing cyclones, on

Professor Oliver's letter of March 17, 1880, in which he had to state that it was not serviceable, and telegraphic reports are furnished, in 1881, being now followed with a similar service in 1881, and in France in 1881. The United States was the first government to establish a permanent weather service, although the subjects were the products of a modern and progressive character of science, and in commencing the project of a permanent weather service. In 1880 Professor Oliver had also published a weather bulletin and forecast at Cincinnati based upon simultaneous observations received by telegraph from all stations.

From the introduction of the electric signal telegraph in 1844 down to 1880 there had not been any suggestion for a government weather service, so were made by many in this country. Finally the increase of the demand of the weather, and the fact that the United States, so numerous the property and the interest of the country by the time it had represented relatively the destruction of life and property by storms on Lake Michigan and Congress, in 1870, proposed of a bill introduced by General Hallard B. Howe, was intended to appropriate money to maintain a service. Colonel Albert J. Myer U. S. Signal Officer at the United States Army was directed the duty of organizing a federal weather service by employing over the country as observers to make daily observation of the country and

The system by which the United States Weather Bureau of the present day, a system of observations and makes weather forecasts have been described as follows: "The morning at 8 o'clock, Washington time—when the sun was, is a point to look at it ought to look at Denver, and 4 o'clock at San Francisco.

The observers at about 100 stations scattered throughout the United States were taking the observations and from carefully tested and standardized instruments, a large all the elementary elements of the state of the air at the bottom of the ground, actual temperature, wind, and which, by its variations of heat and cold, and

---

ness of man, but has commercial and personal welfare.

By 1880 it is necessary that practical corrections have been made, the observations have been reduced to a standard, and each one been fixed at the local telegraph office. During the next 30 or 40 years these observations with the right of way



over all lines, are speeding to their destinations, each station communicating its own observations and receiving in return, by an organized system of telegraph circuits, such communications from other stations as it may require. The observations from all stations are received at such centers as Washington, Chicago, New York, and other large cities, and many of these having a West or Beyond station receive a sufficient number of reports from other cities to justify the issuing of a daily weather map.

Before examining the synoptic wind charts it may be well to glance at the Central Office at Washington, where the observations are being collected, so as to get a glimpse of how the charts are made for the study of the forecast official. From there he gets a particular view, not only of the exact conditions of the air over the whole country at the moment of taking the observations or a hour before, but of the changes which have occurred in those conditions during the preceding 24 hours. As fast as the reports come from the wires they are passed to the Forecast Division, where a number of statisticians take of the reports and translate the cipher into letters and words of intelligible sequence. A force of clerks is engaged in making proper representation of the geographical distribution of the different

On blank charts of the United States each clerk comes from the translator's part of each station's report issued to the construction of his particular chart. One clerk constructs a chart showing the change in temperature during the preceding 24 hours. Broad, red lines separate the cold from the warmer regions, and narrow red lines indicate areas showing changes in temperature of more than 1° and green lines show areas yet colder, or a fall of one or two or three, or even up to 5°. He shows successively, that atmospheric disturbances move and operate in the form of great progressive eddies, that there are several points of intensity from which the force of the disturbance emanates, and directions.

A second clerk constructs a chart showing the change that has occurred in the barometer during the past 24 hours. As in the construction of the temperature chart, broad, heavy lines of red separate the regions of rising barometer from those of falling barometer. Narrow lines indicate the zones over which the change in barometer has been greater than one-tenth of an inch.

Here for instance, I pointed out a great expanse of territory, all the barometers are rising. This is to say, that the air is converging, however denser, and proceeds with greater force upon the

and a of this society in the interests of the instruments. It hereby soliciting a loan consisting of \$1000000 raised at a greater height in the proportion to the other structures of the world to give the harmonizers the right as the foreign temperature raised as an expense. The use of the  $\pi$  concerning it to press upon the inside of the wheel is proper. This is quite extremely useful to the weather, since, in contrast with it is precisely weather itself, it is a body who has of itself the same nature as the raising of the raising to the next and which is of the same nature, it gives a great number of the best way of of the subject of such as

[illegible][illegible]

about 200. As yet low, and Lake Michigan would be at once a source "part water."

The former is now that high pressure and low-pressure areas of it moves the country from the west toward the east at a rate of about 100 miles a day, or about 57 miles per hour, as we get and 220 as per hour in a corner that is of the area, under by air, cloud, and other weather, so that if they are drawn down, by the actual action of the elements, indeed they are great and also above the clouds in a way that is far away from the surface of the earth in all directions from the center and that the high-pressure areas so much as we are in the middle of the storm and of course to have a very great effect on the air the we call the low waves.

In the low waves in every part of the air and low waves we have a note that the loss of heat by radiation through the dense atmosphere is much greater than that dynamically gained by the reason, or we can we can assume that the air passages which are in the air are great in from which it is drawn that is not withstanding it is being gained by compression. It is descent it is still far below the normal temperature of the air near the surface of the earth.

The former is now that although it seems that high pressure areas and opposite to the extreme in the west, they do not do so on the land of the earth for the east, but they do so and that the low waves are not so high in the west as they are which have been formed by the air over the great snow and ice fields of the Arctic regions, as was once thought. The answer is now with the fact that in the low pressure areas the conditions of the air and its various movements are exactly the reverse of what they are in the high, that the air is much warmer in the west.

It is by extension that a current of air is drawn and it is with the air that is lower temperature than the air.

We know that while our atmosphere extends upward to an altitude probably of 100 miles, it is so cold above it as to be so cold as it comes from the earth that it is of the air so far as the air is so far away, and that the air is not so cold as it is in the great swells or eddies in the lower stratum of probably not more than 5 or 6 miles thick, that the air is over the whole

being disturbed by one most severe storm.

It is surprising as little aware of the fact that our high-pressure and low-pressure areas alternately drift eastward in periods that average about 10 days each, that they are not in any sense the product of chance, but are part of total great circulation moving about periodically for some distance and in west, for by the action of the winds too warm, vapor-bearing currents are so heated in and from the middle of the ocean and carried far over the continent so that their moisture is condensed and snowed over the plains and mountains. It is not suitable for the formation of rain, that the high, in drawing down the cool, pure air from above, scatter and diffuse the moisture and gas extracted by a downward and the hot gases are rising from a drying region rather than the cool waves created by these high-pressure areas are among the most important gifts of that ice, for later clear, direct and only gives us more oxygen with each dispersal of the large but even more small size of particles that always are in motion over the surface of the earth and all over the globe. But the cold, clear wind, if it could be as it usually is, brings a good change and mental buoyancy in its mighty breath; and if the seventh of our storms come from the north polar region.

The lucky men to us and pass our time as for several regions eastward over the Lakes and New England, proceeding at a steady rate of about the greater part of the remaining distance, for we have their reception in the central region of our continent, states, and then as they move north eastward they can be the always to expect coming to give beautiful panorama, and that many of them cross the Atlantic in the first 100 miles of their journey, and by far the most severe, wind and rain storms that touch any portion of our country originate in the West Indies and travel in a northerly direction to the New York coast or south. At the coast, when they return to the northeast and sweep along our Atlantic seaboard.

During the prevalence of drought in the great central valley, all the low-pressure or storm bands form in the mid and northern polar region of the Rocky mountains. When such roughs are broken it is usually around helped by lows that form in Arizona, New Mexico, or Texas.

From many years spent in daily watching the formation, progression, and dissipation of storms, the forecaster well knows that at times, by a mere rotation of force not shown by conventional

taken at the bottom of the ocean of hydrostatically driven or dangerous and unexpected energy or pressure sources not so far into the ocean, or that the layer over at the center of the storm rises without any pronounced and gradual increase in the energy of the cyclone itself.

There are a few other germane items of which the forecaster has our author at a disadvantage to be reminded. For one, the considerable times the local parents at the observatory in the air conditions during the previous 24 hours are from the known range and give to the reader an impression of what the weather will be in the different sections of the country the following day. By preserving the weather charts and a chart showing the high, middle of the high and the low, not intelligent persons can make an accurate forecast for himself, always remembering that the lows, as they drift toward him, from the west, bring warm weather and moist and rainy or snowy, depending on the place of observation the highs following in the tracks of the lows will bring cooler and probably fair weather.

As we have examined the accompanying charts and after a brief review of the Weather Bureau service, we endeavor to trace the development and progression of several recent cases of storms.

The first we found with the Weather Bureau service, is a typical disturbance forecast with a good warning, which we found Part I. Small and, it seems, are drawn to every weather station from the river ports in the various watersheds. From these points daily telegraphic reports are sent of winds, and temperatures are sent to each descriptive center, and in addition to observations from every one of the meteorological stations of the Bureau, not shown in the chart.

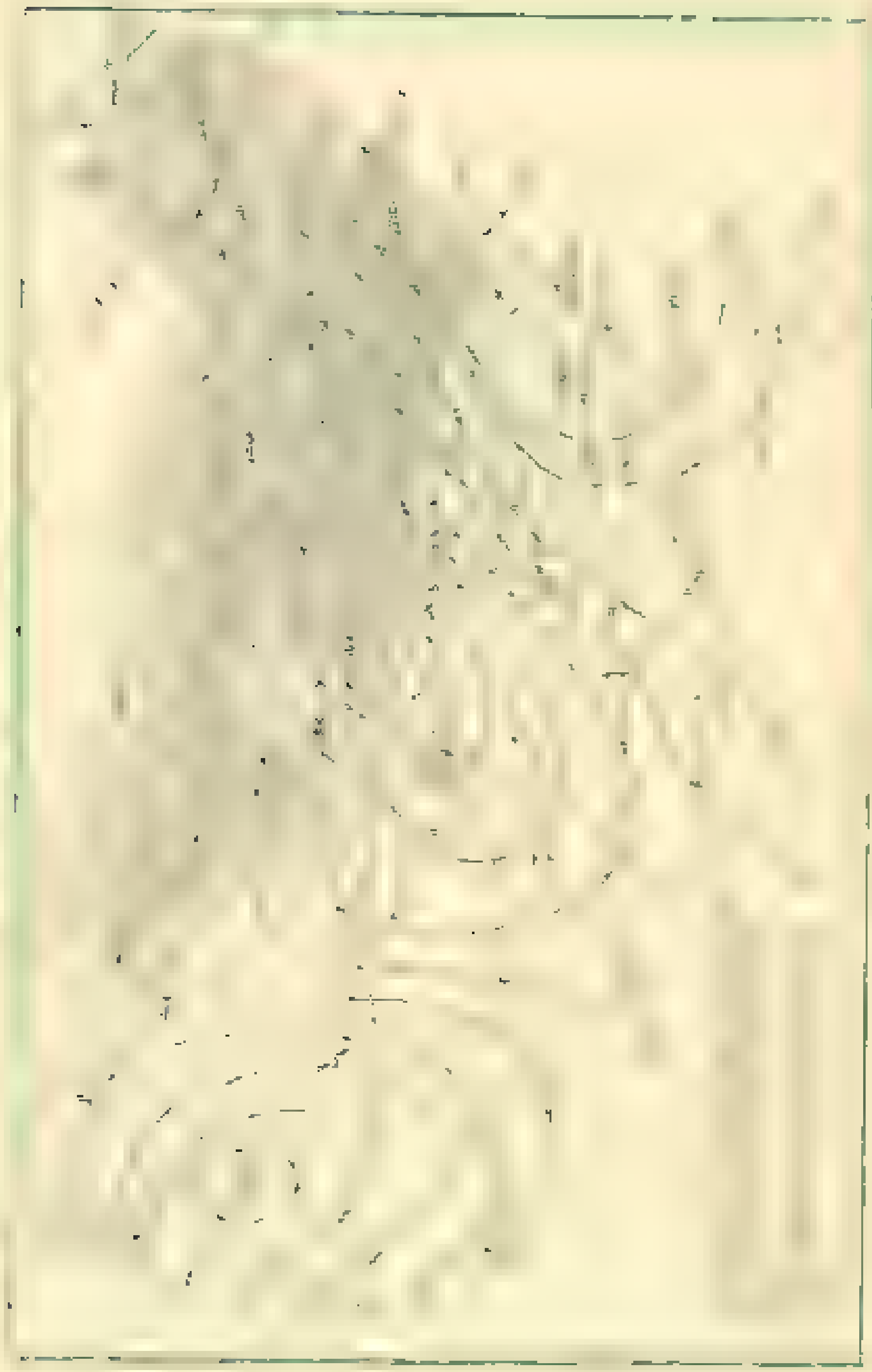
With our many millions of acres of irrigated or even flowing water, one of the most valuable and fertile regions of the world, the vast masses of hydrographic water, the various sections of which, ever are of continuous benefit to navigation and the waterways, and when the precipitation is so heavy as to induce the gathering during the next two or three days, of heavy volumes of the water streams are of a worth, many times more to navigators and to the people having movable property on the grounds and in the water streams.

It is found that in some regions forecasts as to the height of water several days in advance at any station of the system is











next year and the consequent increase may be considered harmful, not to mention the making of sewers, etc. in any the area or a slope of the watershed, and the possibility of the same for a study of the next four or years. It shows the necessity for the flow of the water from the tributaries to the main stream and the time required for the passage of the flood water from one to another. The forecasts are, of course, subject to a wide, but still, they are sufficiently accurate to possess great value to the people of the river country. Some loss of the vast expenditure of property and of funds may be gathered from the statement that the floods of 1881 and 1882 caused a loss of not less than \$15,000,000 in the property interests of the Ohio and Missouri provinces. The same loss of 1881 was in 1882 a great deal more and alone cost a loss of over \$1,000,000 in property.

Chart No. 11 shows a winter storm centered in Iowa at 6 a. m., December 15, 1880. The word "low" marks the storm center at the time. In all the United States where the barometer was taken is to be noted. The heavy black line, which indicates a low too low above the graduation of any barometer, increases up to a certain point and then returns from the storm center at low.

It shows the water level and how, as seen, are a most valuable exception moving toward the low or storm center, thereby decreasing the effect of gravity in causing the water to flow from the several regions marked "low", where the air is relatively heavy, toward the low, where the air is light. As the velocity of water flowing down an inclined plane depends only on the angle of inclination and on the weight of the water, and on the velocity of the wind as it blows along the surface of the earth toward the storm center depends on the amount of the depression of the barometer at the center and the resistance offered by the waves of varying degrees of roughness. The wind velocity is given at one end of the storm wave as the wind velocities. At 6 a. m., where the wind is blowing at the rate of 40 m. per hour, the wave height is 200 feet high, while at Mississippi, where the water level is so low as to be in the stream, the velocity is restricted by the resistance encountered in flowing over a rough surface toward the low, the rate is not great enough to be marked by a special figure.

Now put in your mind the fact that all the air inside the heavy black line marked "low" as it moves inward is



talking about the flow in a direction contrary to the movement of the bulge of a watch and you have a very false conception of an oceanic atmosphere bulge.

Have you ever watched the flow of water of a deep running brook and observed that where it encounters a projecting rock, the water is torn and went spinning down the stream? And our storms are simply great eddies in the air which are carried along by the general mass movement of the atmosphere here on the mid-ocean lap of the northern hemisphere. If they are not due, eddies, as we once said, used. The low marks the center of an eddy, formed by of vast horizons, the extent as compared with the thickness or extension, is a vertical line of air a storm cyclone extends from Washington to Denver in a horizontal direction and yet extends upward but four or five miles. The wind whirl of a whirl goes four or five miles thick and 1,500 miles in diameter is called a cyclone or cyclonic system. It is important that a proper understanding of the phenomena of eddies be had, since the weather sequences experienced from day to day depend almost wholly on the movement of these large eddies, low cyclones, or areas of low pressure.

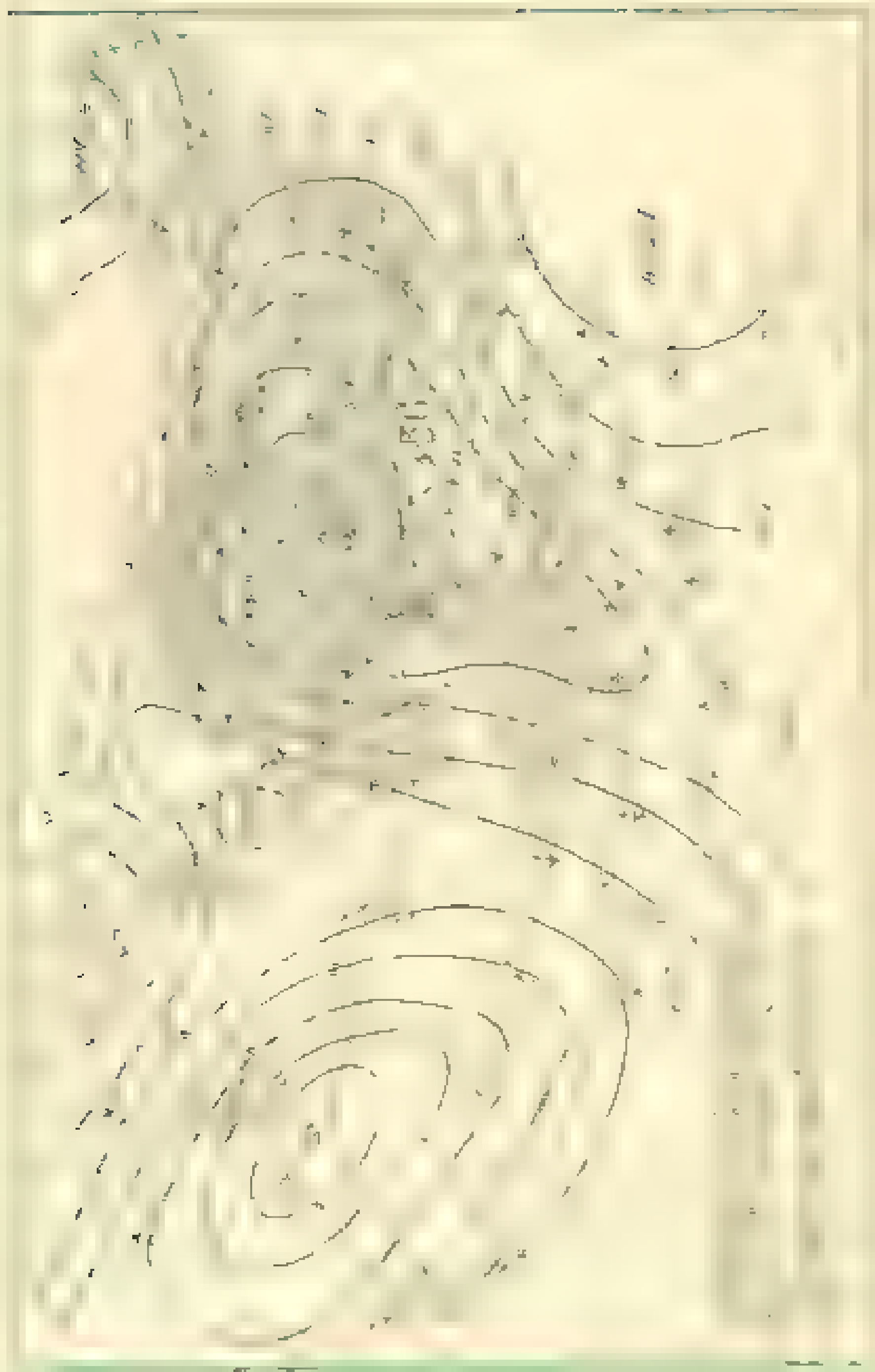
The large figures in the four quadrants of the cyclone show the average air nature of each quadrant. The greatest difference is between the southeast and north-west sectors. The wind is in fact blowing from the south-east, and the air is drawn northward from warmer and less, and in the north-west the wind is drawn southward from colder latitudes. The shaded

12 hours. Unfortunately for the science of forecasting, precipitation does not show that relation to the constitution of the

Chart III constructed from observations taken 12 hours before shows that the storm or cyclone center as indicated by the word "low" has moved from central Iowa to the S. A. P. and is now at 5 p. m., central over the southern point of Lake Michigan. The shaded areas show that precipitation has occurred during the past 12 hours in nearly the entire region covered by the cyclone.

Chart IV, 12 hours later, shows that the precipitation has a general trend from the north and west toward the cyclone which

Chart V is quite descriptive, in the information it conveys, to any other of the charts accompanying this paper. From July 28 to August 14, inclusive, 1906, there was a remarkable outflow of the United States extending from the Rocky mountains to the





1847 GEOG. MAG.

1847 GEOG. MAG.









Figure 10



Atlantic coast. The mortality from this cause amounted to more than one-half the highest region as shown by the dark

lake region, where the temperature averaged from six to nine degrees above or below zero below the surface. The mortality during this period, strange as it may seem, the temperature over the vast Rocky Mountain plateau was markedly below the normal and the cold, was not due so much as is often supposed to these conditions as a geographical effect. The weather charts showing the many winds of high and low during the period of this abnormal heat are not shown on this paper. Chart V is simply intended to show graphically the area and degree of the heat.

It is more inexplicable reason there are, moreover, periods of almost a complete stagnation in the circulation of high and low.

At such times if a high peak over the southern part of the country and a low over the northern Rocky Mountain region,

there will result what is popularly known as a weather wave, or the air, on account of its slightly greater specific gravity, will slowly and steadily flow from the southeast, where the pressure is greater toward the northwest where the pressure is less and receiving constant accretions of heat from the hot, red and gray face of the earth, without a very high degree of heat being set and lower strata, will finally attain a temperature almost unobtainable before. This is indicated on a chart of the lower strata of air from the five countries until the low pressure area in the north-west begins to not only gradually decrease and move eastward, in doing so its course struck off a rapid temperature and a fluctuation of the mass and we enter the same conditions.

It is a point well known whether such an occurrence of abnormal heat and abnormal cold can possibly be due to cause of the earth.

The only cause of abnormal heat and cold is due to the action of the sun and the heat from the sun to the earth and the reception by space of the heat that is radiated back by the earth and atmosphere. But in doing so, these two balance each other. It is irrefragable that solar radiation passing outward from the sun along lines of equal force, each line is equally strong and the heat from the sun is excessive heat on one side at the extreme of the line and the other. It is, therefore, the product of the sun is not to show a description of the heat, but to show that the sun is the cause of the weather on the earth.

Weather varies in its progress from the north and south from the equator to the poles and the weather on the earth is the result of the sun's action on the earth's surface and the atmosphere.

is a subject not yet decided upon. The mechanism of the latter is not known.

It is necessary to explain the great differences in temperature shown on the same day of departure for July and August, 1896.

On the upper surface mountains nearly the same configuration as the topography and is almost entirely motionless relative to the earth's surface. The solar radiation and the terrestrial radiation penetrate the upper region without appreciable ab-

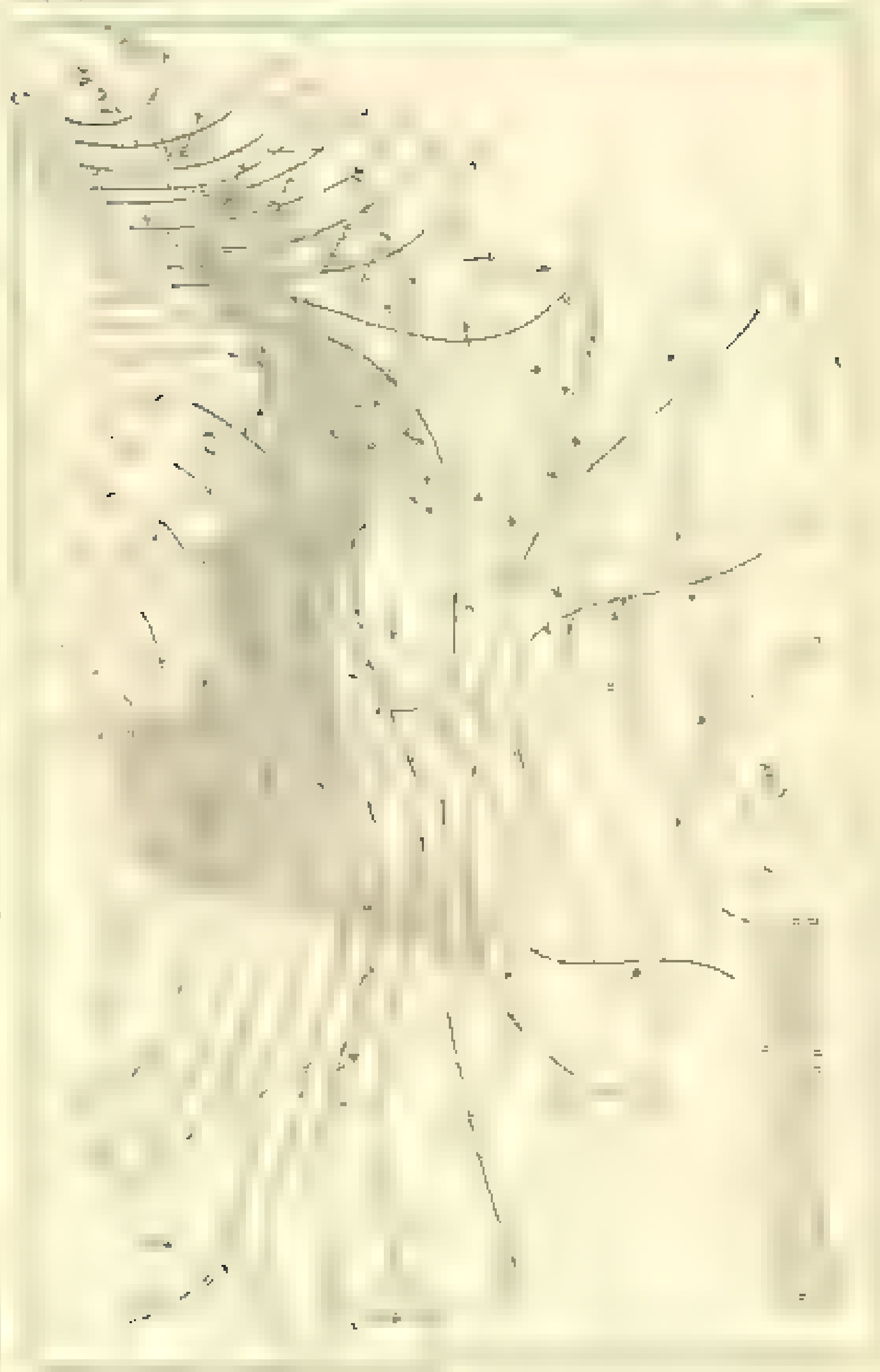
sorption, and the rays increase before they reach the surface. Our atmosphere is not so transparent as the changes going on in the middle and lower atmosphere, and an increasing layer of air which absorbs the solar temperature, most is the reason of the atmosphere. The great contrast in temperature between two regions, and also between as shown by Chart V, is therefore probable and can be explained as an influence, but to the flow

Chart VI shows the beginning of a cold wave in the north-west on the morning of January 7, 1901. Observe that the heavy, black storm passing through Montana is marked 31.5, while the polar current passing through southern Texas is marked 5.5 and therefore of the cold air. The isobars are between Montana and Texas. The dotted vertical line in Montana is marked all degrees below zero, and the isobars on the Texas coast are marked a temperature of 50 degrees.

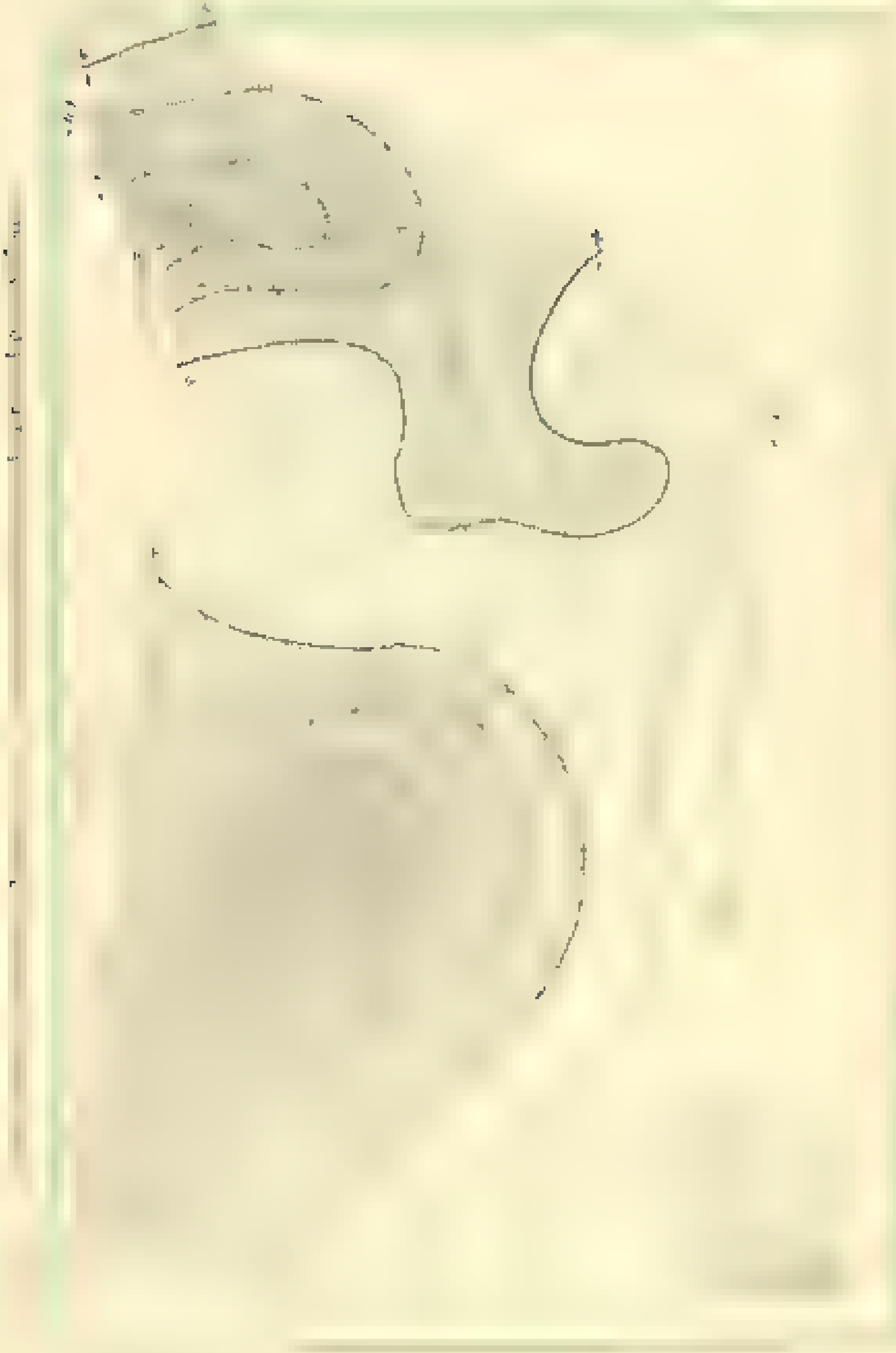
Chart VII is only a copy of Chart VI, and by varying degrees of pressure and temperature of the northwest. It is a section of area covered by the highest pressure, and is a full set of degrees in temperature, and in the pressure.

The pressure of the cold states, with a morning temperature of 40 to 50 degrees, shows that the great pressure of extremely cold air to the northwest of Texas; but from the distribution of the pressure shown by Chart VI the forecaster anticipated that the center of the low pressure system would, on a series of days, great winds, or forces, be thrown to the Gulf of Mexico, eastward to the Atlantic Ocean; or, more accurately speaking, that the cold air would be forced to the northwest and then to the southward and eastward. He then foresees the proper weather to be expected and predicts.

Good Wave, January 7, 1883, 7 a. m.











Dr. J. W. Watt, January 8, 1980, 7 p. m.





On the other hand, the two-dimensional projection of the







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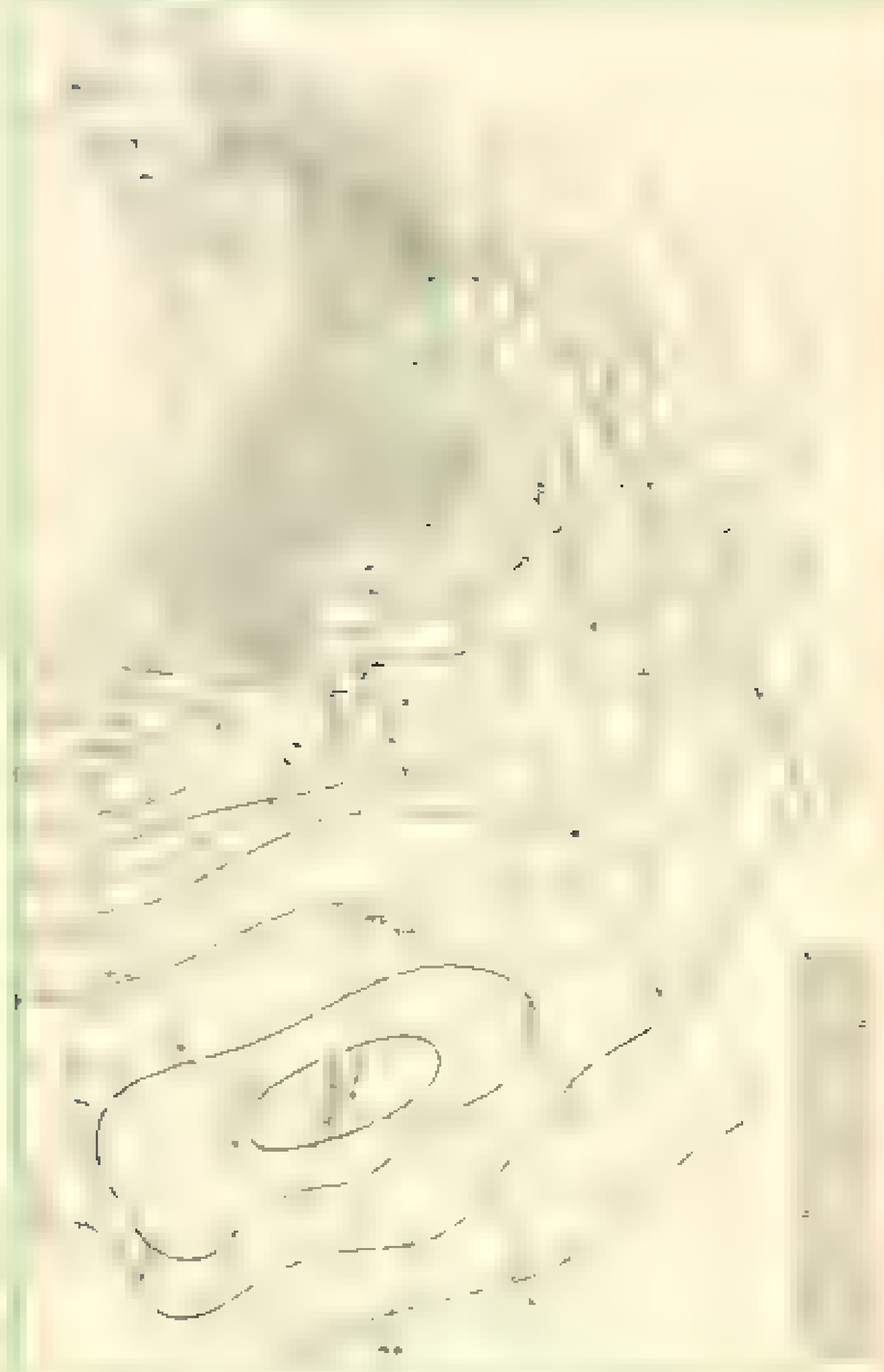








Old Wave, January 10, 13. O. Y. A. R.









Now turn to Charts VIII and IX of the following meeting and it will be seen that the latter that covered wave has only one, the three hundred p. m. y. T and shown on the present map that as being covered in southern Texas has moved northward to the coast, as shown on Chart VIII as points as a fully developed.

Now. The reference to pressure here on the central portion of the low and the central portion of the high is now 14 p. m. Precipitation has occurred, as shown by the dark shading.

Special attention is called to the large squares placed in the four quarters of the low pressure area about 1000 miles from the center. They indicate the average temperatures of land respectively quadrants, as is strikingly illustrated how great may be the difference in temperature in one day and in one place between regions separated by but short distances. It is certain that as the low cyclone which moves toward the northeast, along the track usually followed by storms in this locality, the cold of the

the temperature in the range grows to below the freezing point.

Chart X shows that the center of the cyclone or low pressure system has moved during the previous 24 hours northward to the coast of New Jersey, with greatly increased intensity.

287 inches. Cold northeast winds as shown by the arrows are now blowing systemically from the high pressure area of the

coast. The coldest and most of 30 degrees passes through the northern part of Elkhart, where on the day before, the temperature was over 60 degrees.

The eye of a great one of 12 is at center extends 1000 miles in diameter and probably to an equal distance out to sea. Heavy snow or rain has fallen, and rain is

under the surface of the heavy ice. A railroad travel and a

has been proven when the coast. But when

the storm was covered in a storm all

Chart XI shows the temperature changes caused by the arrival of the storm system.

Charts XII and XIII show the count on 24 hours before. The storm center has been three days in passing from southern Texas to the mouth of the St. Lawrence. The temperature has fallen and lower on the Atlantic coast and at Elkhart as the result of

the one nearest the high pressure of the northwest is replaced by a low pressure, and counter-clockwise currents are drawn toward the northwest, instead of being forced as it were from that region.

To summarize in regard to cold waves, it may be said that where the charts indicate the formation of a cold wave, a belt of cold air moves, as shown by the barometer readings, the sky and forecast, and the wind. It calls for special observation every four hours from the weather watch and a bulletin at intervals of four hours, and as soon as the weather conditions indicate the cold wave will sweep across the country with its attendant loss to property, destruction to animals, fire, and diseases, fact to quantity, the weather-forecast system of dissemination of warnings is brought into action, and by telephone, teletype, large collections, maps, and other agencies the people in every city, town, and hamlet and even in foreign settlements, are immediately notified of the advancing cold wave, even, of course, or perhaps even, thirty-six hours before it comes to the coast.

Charts XIV and XV show the cyclonic systems prevailing at 8 p. m. on the eve of the Louisiana and St. Louis tornadoes, severe and rapid as occurred on each day. Their tracks are shown by rows of crosses, the so-called squarings of each cyclone.

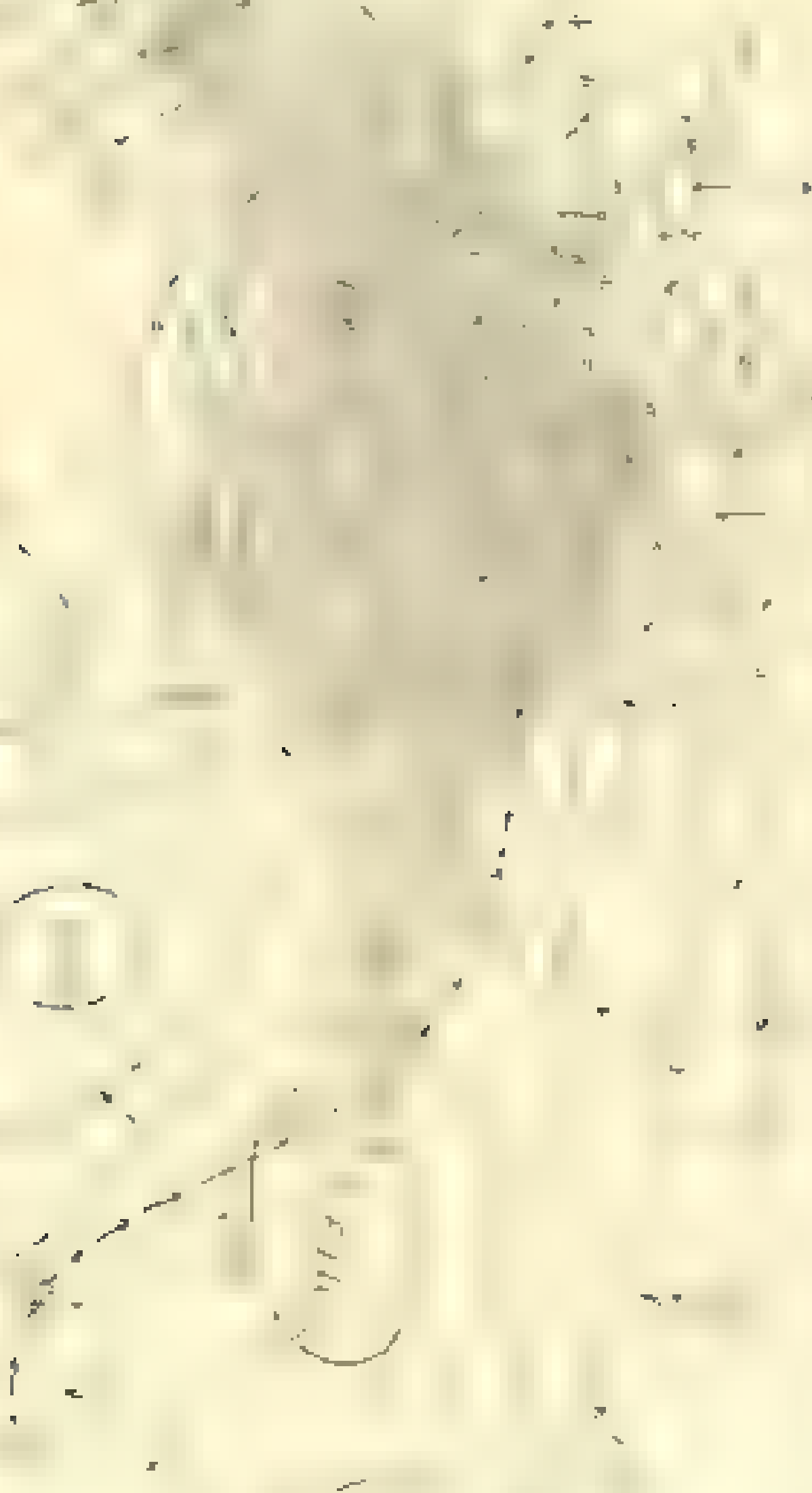
Especially do I wish to say, basing the deduction between the cyclone storm and the tornado. The press and public of the Mississippi and Louisiana had received these forecasts as evidence that the cyclone storm is a giant XIV, which is hardly to be said of an eyeless as a horizontally revolving mass of air, covering the whole Louisiana from the Atlantic coast westward, and including the Mississippi valley, with the air currents from all points flowing up the gyration and toward the center, where the tornado is a revolving mass of air of only one to four yards in diameter and less rapidly an object of the cyclone, many ways reaching its southwest quadrant. The cyclone may cause moderate or high winds through a vast expanse of territory, while the tornado, with a rotary motion almost unobscured, always leaves a trail of death and destruction in its area, and in some instances to the area covered by the cyclone.

The tornado is the most violent of all storms, and is more frequent in the central ranges of the United States than elsewhere. It has characteristics which distinguish it from the thunder-storm, viz. a peculiarly funnel-shaped cloud and a violent, rotary

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of a watch together with a violent up-draught in the center

100



showing the trunk of  
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It is there that the conditions for the formation of tornadoes are exactly as follows: 1) A cyclone or area of low pressure, the center of which is to the north or northwest, with a barometric pressure at the center is much lower than around, 2) a low bearing of about 20 degrees in the morning hours. It is great for me to say that at the time of year be March 15 to June 15. These conditions may and often do exist separately; one or two of them may be found existing, but so long as the third is absent, forming a formation is a likelihood to occur.

I am satisfied that the number of those persons concerned, representing that the breaking of the virgin soil, the planting or cutting

[illegible]

It is not possible with our present knowledge of the mechanism of storm waves to return the exact degree and direction of the vessel as found on the 11th morning and it is, therefore, not well wholly over to injury, but we know that tropical waves are most commonly confined to the sea between 40° north of the equator and that when the storm fully develops and alterations are beyond the 100° and 200° meridians southward from the cyclone center is in the greatest danger.

Chart XV shows the evolution in evening of the St. Louis L. made, two hours after its occurrence. The abnormal heat from the eye and other conditions of the rather small and weak eye-muscle system shown in the morning chart were sufficient to justify the Weather Bureau in distributing an extraordinary danger

I am informed that the schools of St. Louis were closed at once on the receipt of the warning forecast. What is urgent.

4.  $\text{int}(\text{type}) = \text{time}$ .

A few were visited St. Louis the day after the storm, and I was especially impressed with the fact that squares or rectangles were least outward, at their upper stories, indicating that they were at the base of the restricted inward movement of the rising mass of air where velocity and force instantly had maximum

pressure on the outside to which they bent that the expansion of air at the upper stories of the houses was shut off down and doors were closed, and produced an explosion of the building, as a rule, as at the four walls of the upper story of a house were thrown outward leaving the lower story intact and level resting in proper position at the story lower than its original position. Again a great structural seemed to have been struck on or torn down suddenly and set loose in all directions.

It is true that it is true the forested with the native forest for a several miles of a thick land mass and yet left the city with greater force than it possessed in coming. It is estimated that a lot of planting forests to the southwest of a city for the purpose of protection as we have advocated. It is probable that the strongest trees would offer but little more resistance to the force of the storm than would so many blades of grass.

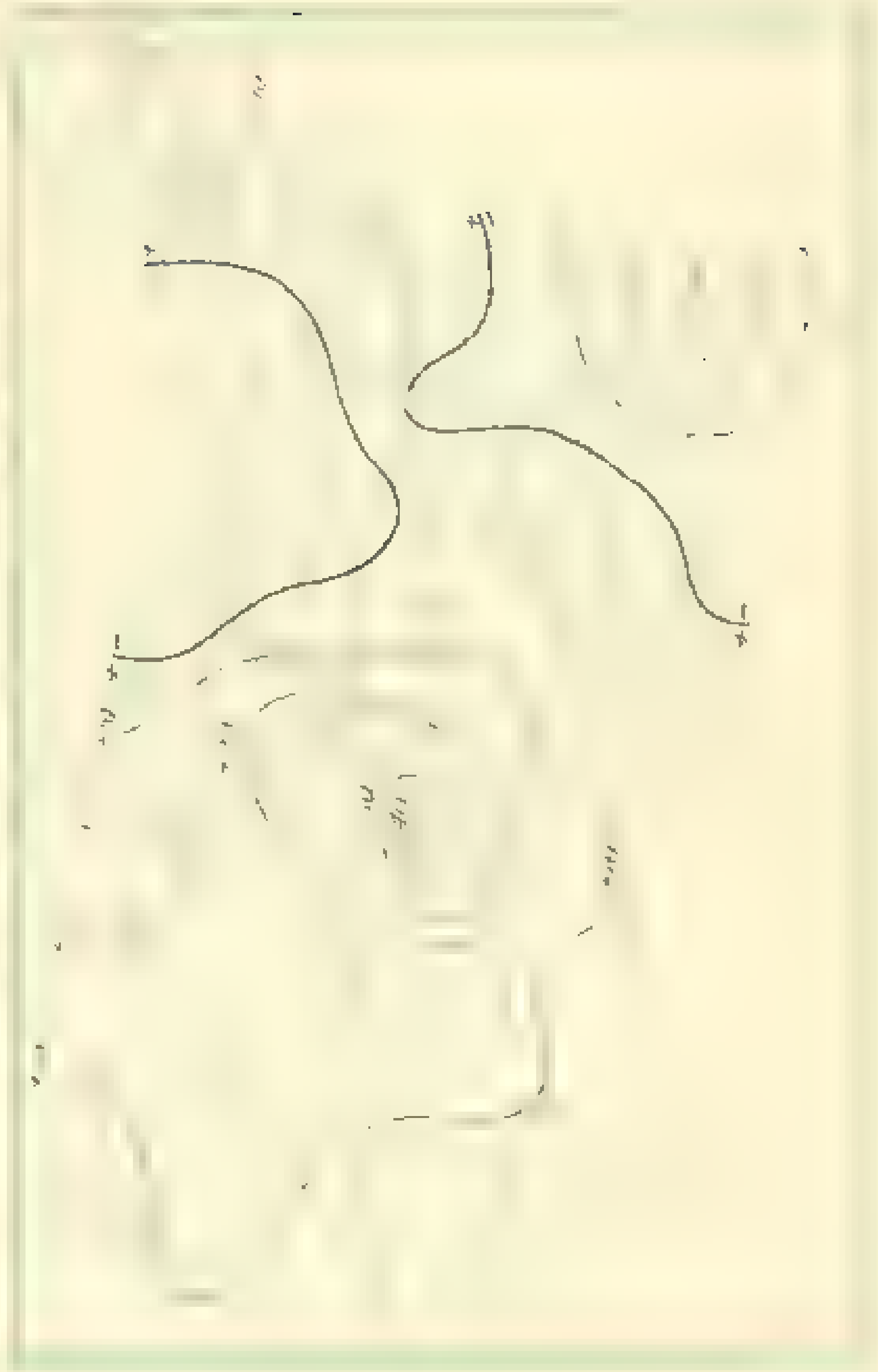
Whenever the forecast is made a statement that the storm is the latest the forecast is made, it is well for the forecasters to have a reliable forecast as observed carefully and to report the results of the forecast as they tend to seek places of safety in the course of the forecast. We have no record of any person having been killed in the course of a storm or during

that XL was a West Indian hurricane just making its advance on the Florida coast. A number of storms in the West Indian and West Indian by cable whenever hurricanes pass over the water. Sometimes a hurricane is composed of a rapidly revolving eddy of air of only two or three hundred miles in diameter passes between the observation and one of the islands of the West Indies without getting near any

inhabited. Then, if it moves rapidly toward the coast, it may reach our mainland unannounced. Fortunately such cases are rare, it is the case the storm does reach any point a very early warning signals will be displayed. A number of the coming throughout the remainder of the coast to the lowest of the coast. At times hurricanes run a second stage to the Gulf of Mexico, and the only indication we have of the proximity is a strong wind blowing for a brief overcast of a few minutes toward the center of the Gulf. Again, a











27, 1893, 8 P. M.













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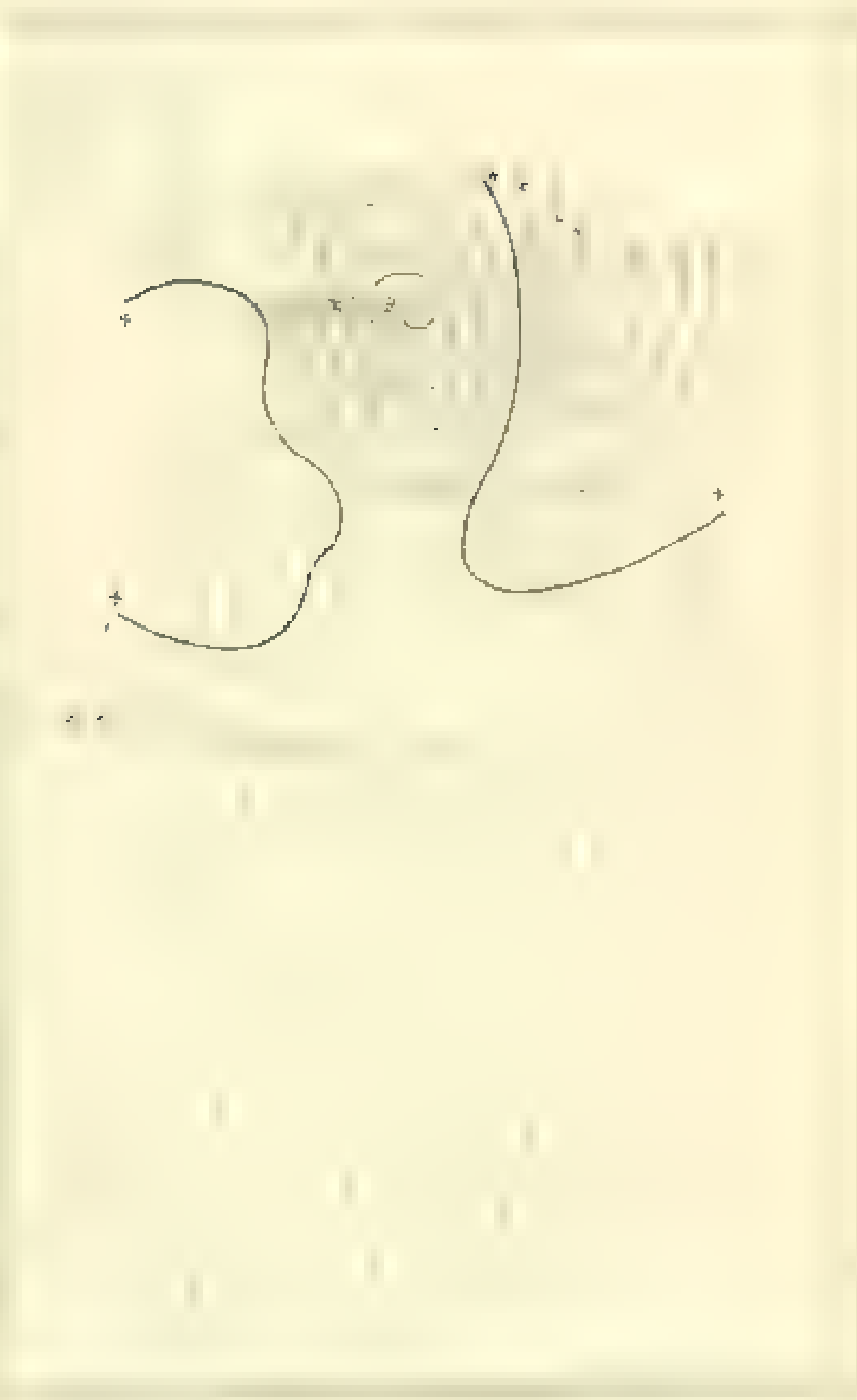




West India Hurricane, August 20, 1883.







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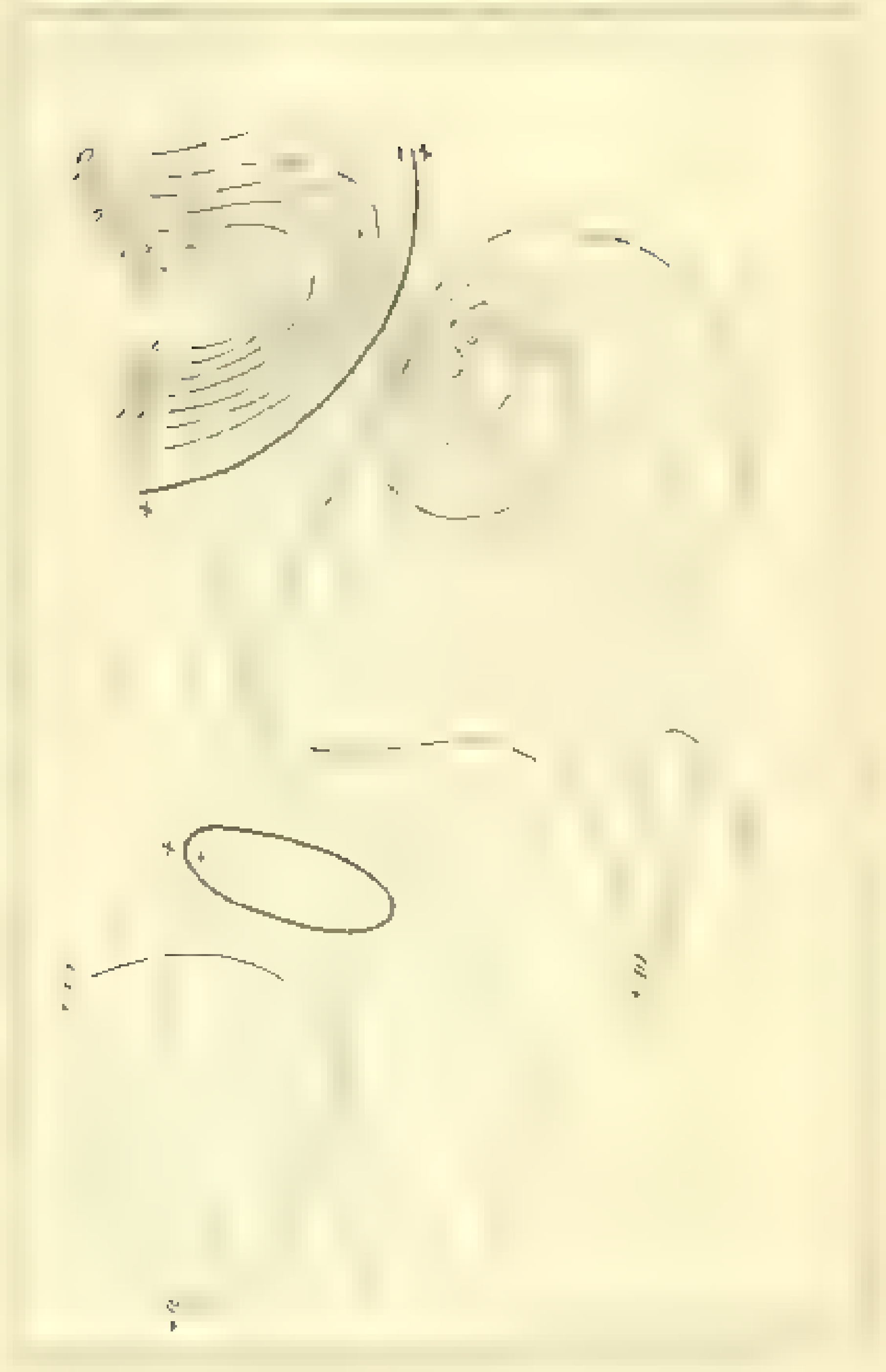






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heavy rain, wind may be checked by the fact that the rapidly overlying air on the surface of the water, at 101.4, is too heavy and has a strong progress, probably great, the wave may be propagated outward from the center of the storm faster than the storm is being built up, and the wave may travel more rapidly than the barometer of the wind above, and gives an indication of the coming storm.

The tracks of West Indian hurricanes are always in the form of a parabola. These storms are from the southeast, and reaching the latitude of the Gulf coast, curve to the west, and at length our coast line. An examination of the auxiliary chart on the opposite page shows that the air pressure in the region of the storm has decreased 10 to 20 of an inch during the past 12 hours, and that the course of the arrow shows on Chart XVI from New Orleans, to indicate that the forecast of what the West Indian has ordered up, the storm signs are an indication that the storm will move up the coast and increase in energy.

Chart XVIII two volumes later shows that the winds were timely, as the storm center has moved slightly northward to Jacksonville, and greater masses of energy, the barometer of the center reaching 29.1 inches which is about 10 of an inch more than the mean air pressure. The auxiliary pressure has decreased more rapidly during the past 12 hours than during the same period next preceding. The most important observation regarding motion of the ridge of anticyclone was the vast amount of heat energy liberated by condensation in the white clouds.

That it should have been carried so farward to Norfolk, and being so far off the coast of a center have been warned that the dangerous winds will come from the northeast. I wish to make plain that the storm coming from the southwest enters northward to be in its front. On the New York and Florida coasts the signals have indicated that the wind will blow from the southwest for a few minutes, as the meteorological bureau the recording station is about 100 miles away from the point where the storm is progressing against the wind.

In the extreme this record of 101.4, there is a barometer falling of the above zero, caused by cold and heavy air from above draining them down into a cyclone and a particular storm next day. This falling motion has been observed there and in the section in which it is observed to be moving.

Chart XX shows the general character of the north-east course of



RUBBER FORESTS OF MALACCA AND SEHOA  
JUNE

By the way, the  $A_1$   $W_1$  channel is

1. *How do you feel about the way the world is changing?*

[illegible][illegible]

That forest is doing a remarkable amount of work as a sink for greenhouse gases, while a popular drought-stricken region has almost double the usual carbon loss. Trees and the soil together remove an additional 1.5 metric tons of carbon per hectare a year, or about 10 percent of the average amount of carbon lost by the forest.

There is no hotel in 1910 the nearest of which, located 18 miles out of town, is, according to the report of the same day, "a very good example of the organization of a hotel of the past."

The spider-gatherer is out of his hole as good as it is light in the morning and takes his gulp of noon. It is quite a new experience for him to step out to the big pine trees. He wears a set of jaws of brass and iron and makes a clart. He goes home for a moment while turning, he sweeps it, and one of the legs up to his knees, and then up to his waist, a water. He





well-known fact that in any cultivation the tree would probably equal the other in overall quantity but not in quality and in fruit production. It has the advantage that if one of its trees is destroyed by any severe damage or disease, it has several others to take its place which bear a large quantity of fruit. Another good variety is the one used here in China known as the "apple of seven" because a tree, in large harvest, bears as much as seven at a time (100 to 200) in a year. It is common.

[illegible]

After waiting to take the next north-bound Steam train, he leaves with a pack of men and a few cows and horses to the west. It is a rocky trail, the steep volcanic slopes can no longer be cultivated, with only a few patches of crops to be found.

John was around her trunk, sat at a nursery when one year old, and the woman + to their power what place in 2 years of age, in the way, of that and, 8% place on last in the person.

[illegible]

The two following modes of transport are peculiar to the process—(1) that a curved, sharp indentation can be made along the bud before it enters the flower tube in pine trees and (2) that no such hole in the flower tube is made before it is from the pollen tube of an ornamental species. Nor is it strange that the first marking is not made at a point of the strength of the flower bud, as it is not made at all in 1 to 2 in. long into the tree, but, when the bud is young,



















**ELECTIONS.**—New members have been elected as follows:

*February 26*.—Miss B. J. Baird-Hay, Judge George S. Botscheller, Mrs. Tina Albertini, Alex. Everett Frye, George B. Hollister, Mark S. W. Jefferson, Albert M. Leveyer, Robert H. Parson, Mrs. Alpha Gibbs Powell, Miss Mattie Scott, Mrs. George Westinghouse, Gen. R. P. Williams.

**DEATHS.**—The Society has recently lost, by death, the following named members:

Mr J. M. Cunningham, of San Francisco; Mr Joseph Macfarland, of the U. S. Geological Survey; Hon. J. Randolph Tucker, of Lexington, Va.; General Alfred Pleasanton, U. S. A.; Mr Lewis Clephane, of Washington, D. C., and Mr L. P. Smith, of the U. S. Department of Agriculture.

## GEOGRAPHIC NOTES

### CENTRAL AMERICA

**Nicaragua.**—Concessions have been granted to United States citizens for a steam railway to be operated by steam between the towns of Bluefields and the Bluefields custom-house, situated at the mouth of the harbor, and also for a railway between Rama and San Uladito. The United States consul, however, makes the significant statement that "so little has ever been done in Nicaragua under any government concessions, big or little, that it seems a waste of time to enter into the details of any concessions without positive proof that it is to be practical."

A contract has been let for the construction of a canal to connect Pearl and Bluefields harbors, which will afford an inside channel with a depth of 4.5 feet for a distance of 35 miles north of Bluefields.

### KERUPE

**Russia.**—On September 13 the total length of railways in operation in Russia was 38,861 versts, or about 54,000 miles. Of these lines, 23,438 versts were operated by the government.

The development of the mineral and manufacturing industries of Russia is progressing with astonishing rapidity. The production of coal has tripled in the last 15 years and the progress in the textile industries is unexcelled. The empire, however, is still largely dependent upon other countries for its machinery and upon foreigners for the more responsible positions in its factories and ironworks.

There has been an enormous increase in the shipping industry of the Caspian sea, owing to the development of the oil wells of Baku, one of which recently discharged 300,000 tons of oil, valued at \$700,000, within a period of two months. Several of the Russian railways and most of the steamship companies on the Volga, as well as the manufacturing centers along that great waterway, are using oil for fuel.

### ASIA

**SWEDEN.**—By consent of the Russian authorities the peninsula discovered by Dr Nansen is to be named for King Oscar of Sweden.



Over 50,000 Russian peasants migrated to Siberia in 1896, but some 25,000 were forced to tramp back to their miserable homes, owing to the land set apart for colonization being insufficient to meet the demand.

SYRIA. A stranger is now making regular trips from Jericho to Tiberias—*i. e.*, from the Dead Sea to the Sea of Galilee—in five hours. Several Jewish families recently settled in Jericho and are preparing to irrigate extensive fruit farms.

JAPAN. The Russo-Japanese convention has been published in St. Petersburg. It provides that Korea shall retain full liberty of action as regards both domestic and foreign policy. Russia and Japan will each keep a small force of troops in Korea until such time as the government can maintain order.

INDIA. It is estimated that the present famine in India would have reduced the population of that country by 10,000,000 if it had been allowed to run its course unchecked. Over 5,000,000 persons are employed on government relief work, and hundreds of thousands more are being moved out of the land (now amounting to the equivalent of nearly \$1,000,000) contributed in the British Islands.

#### AFRICA

TRANSVAAL. The total output of gold for November was 301,113 ounces, as compared with an output of 105,316 ounces in November, 1895.

MADAGASCAR. The French Colonial Minister has announced the intention of the government to maintain the equality of all religions in the island of Madagascar. He has forbidden, by telegraph, the proposed confederation of Protestant churches.

ALGERIA. According to the recent census, the city of Algiers contains 105,000 inhabitants, 45,480 being French by birth or naturalization, 9,000 Jews, 25,000 Arabs or belonging to other native races, 9,800 Spaniards, 3,500 Italians, 1,100 Maltese, and 215 English.

CENTRAL AFRICA. Mr Paulott Wetherley, an Englishman, who recently visited Old Chitambo, where Livingston's heart is buried, calls attention to the decay of the tree that marks the spot, and suggests the necessity of the immediate erection of a more enduring monument.

EGYPT. During the recent Sudan expedition the number of all ranks of the Egyptian army killed in action was 47; the wounded numbered 122; 255 of all ranks died of cholera, and 126 died of other diseases. The Egyptian troops are said to have displayed great powers of endurance and a remarkable capacity for hard and continuous work.

WEST AFRICA. Whatever British influence predominates, railroad building is in progress. A line is in operation from Dakar, the chief port of Senegal, to St. Louis, 173 miles north. Another line runs from Kayes up the valley of the Senegal toward Timbuktu, which it will soon reach. A line from Conakry to the Niger is also in contemplation. Dr Karl Peters recently stated in London that the whole African question was one of communication.

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